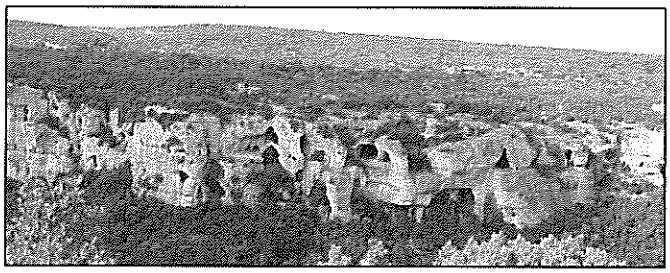


UNIT 9: WEATHERING AND SOIL DEVELOPMENT

STUDENT NOTES PACKET

ABSTRACT

This unit covers the breakdown of rock materials and formation of soil. It begins to delve into what we term "leveling forces" that is continued in Unit 10: Erosion, Deposition, and Landscapes.

STUDENT NAME:

TEACHER COPY

NYS Regents Earth Science
Unit 9: Weathering and Soil Development Notes Packet
After Unit 9 you should be able to:

Mr. Burgess

- *Accurately identify common types of weathering*
- *Understand what types of weathering are associated with certain climatic conditions*
- *Be able to identify resistances to weathering in bedrock diagrams*
- *Understand what happens to sediments as they are transported in a stream*
- *Understand the process of cavern and sinkhole formation*
- *Understand the process of soil development*

Unit 9 vocabulary you should be able to use and understand:

- *Weathering*
- *Erosion*
- *Deposition*
- *Physical weathering*
- *Chemical weathering*
- *Frost wedging*
- *Abrasion*
- *Pressure unloading*
- *Rounded*
- *Angular*
- *Striations*
- *Polished*
- *Acidic*
- *Sinkhole*
- *Cavern*
- *Chemical sedimentary rocks*
- *Climate*
- *Bedrock*
- *Particle size*
- *Surface area*
- *Bedrock resistance*
- *Hardness*
- *Mineral composition*
- *Rock outcrop*
- *Cap rock*
- *Waterfall*
- *Soil*
- *Biologic activity*
- *A soil horizon*
- *B soil horizon*
- *C soil horizon*
- *Precipitation*
- *Arid*
- *Humid*
- *Strata*

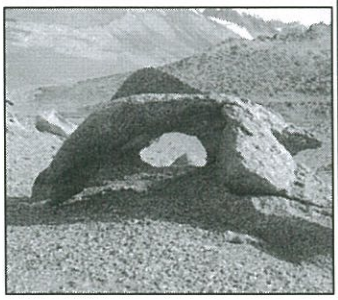
The next two units focus on leveling forces, or the breakdown and transport of rock particles through weathering, erosion, and deposition. These processes are part of the rock cycle that make sediments available for compaction and cementation to become sedimentary rock. Landscapes change dramatically as a result of these processes, as you will learn. New York State is (with the exception of the Adirondack doming) being dominated by leveling forces. Unit 10 focuses on the processes that break down rock into sediments.

What is weathering?

- WEATHERING IS THE GRADUAL BREAKDOWN OF ROCK OVER TIME
- *This should not be confused with erosion, which is the removal of rock and rock particles from an area*
- *Deposition is the stopping or settling out of rocks and rock particles*

Types of Weathering:

- PHYICAL OR MECHANICAL
- CHEMICAL



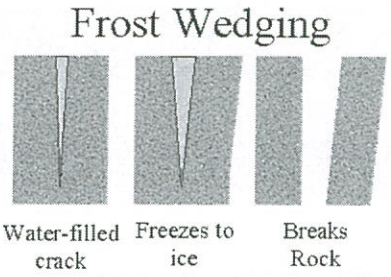
Physical (Mechanical) Weathering

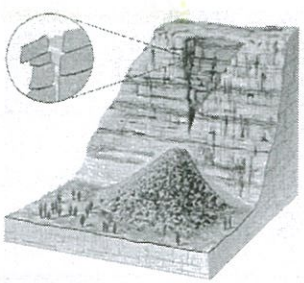
Major Contributors:

1. FROST WEDGING
2. ROOT WEDGING
3. ABRASION

What is frost wedging?

- FROST WEDGING OCCURS WHEN WATER ENTERS CRACKS IN ROCK AND FREEZES
- As water freezes, it EXPANDS 9% and pries the rock apart





What is root wedging?

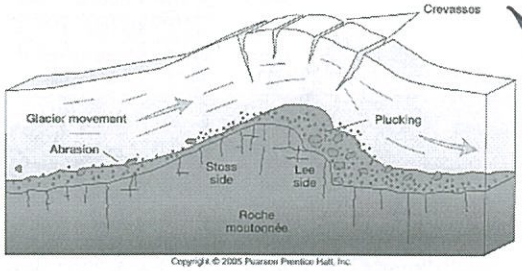
- ROOT WEDGING occurs as the ROOTS OF TREES AND OTHER PLANTS GROW INTO CRACKS IN ROCK
- Over time, the GROWTH AND EXPANSION of these roots slowly PRIES APART the rock.

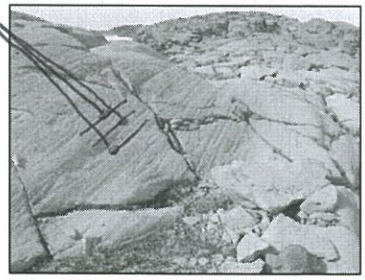
Abrasion

- ABRASION IS THE BREAKDOWN OF ROCK AS IT IS SCRAPED BY LOOSE ROCK PARTICLES
- ★ IN RIVERS ABRASION RESULTS IN ROCKS THAT ARE ROUNDED RATHER THAN ANGULAR

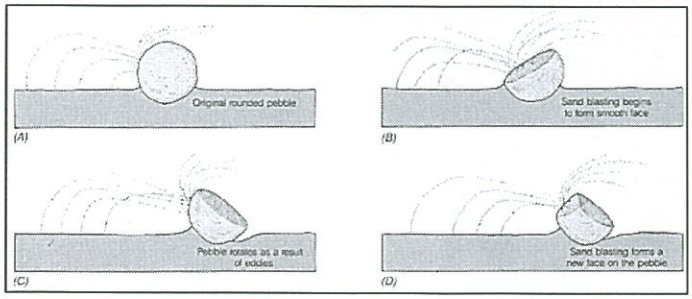
- ★ Glacial abrasion results in polishing of rock and STRIATIONS (PARALLEL SCRATCHES

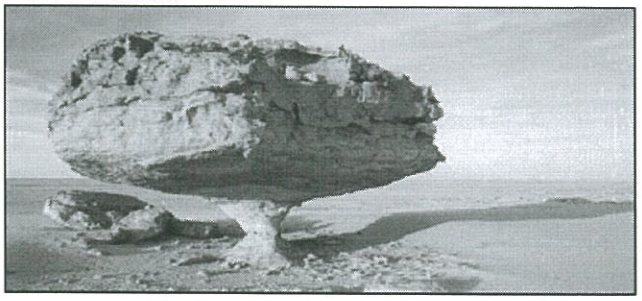
STRIATIONS





- WIND-BLOWN SAND PITS ROCK FACING THE WIND





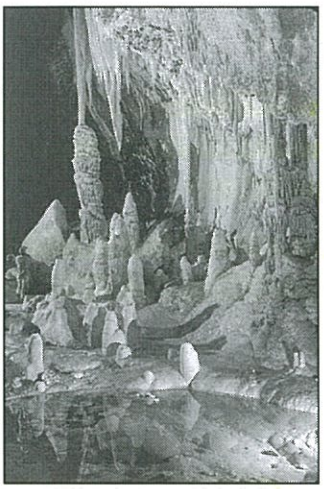
What is chemical weathering?

- CHEMICAL WEATHERING IS THE BREAKDOWN OF ROCK DUE USUALLY TO CONTACT WITH ACIDIC GROUND OR RAINWATER
- *Contact with oxygen can result in chemical weathering as well*

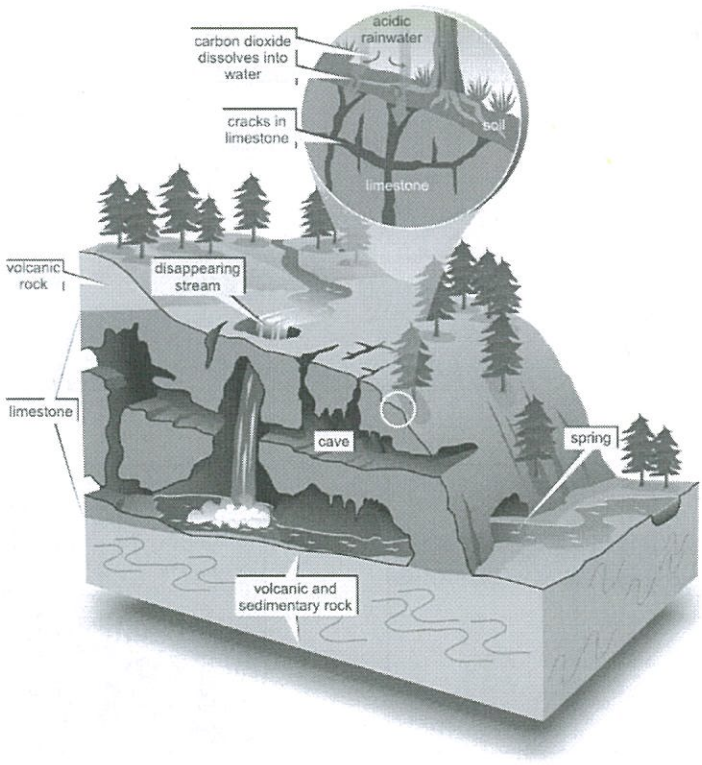
Consequences of Chemical Weathering

Sinkholes

Caves

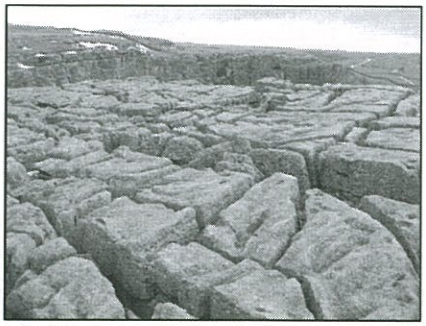


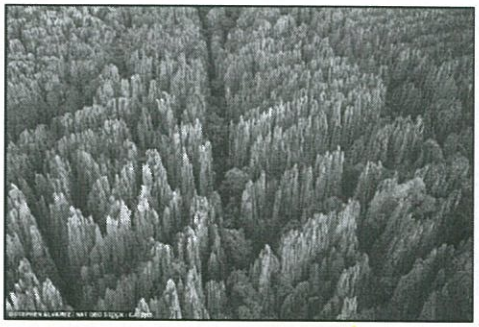
Cave and Sinkhole Formation



Chemical Weathering of Strata (Layers)

- ROCKS SUCH AS GYPSUM, ROCK SALT (HALITE), AND LIMESTONE ARE MOST SUSCEPTIBLE TO CHEMICAL WEATHERING (ALL CHEMICALLY FORMED SEDIMENTARY ROCKS)





What affects rates of weathering?

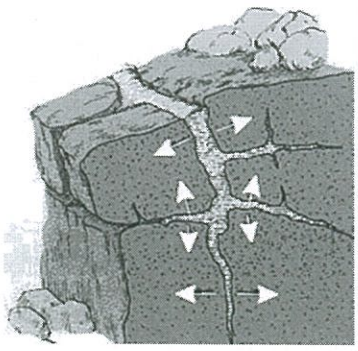
- CLIMATE
- BEDROCK TYPE

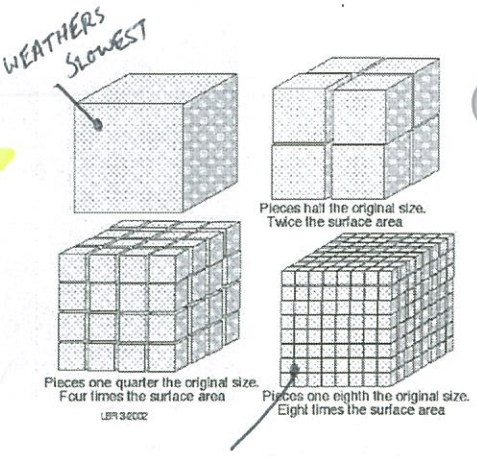
How does climate contribute to weathering? ★ VERY IMPORTANT

- WARM, WET CLIMATES CONTRIBUTE TO HIGHER RATES OF CHEMICAL WEATHERING BECAUSE THERE IS AN INCREASED PRESENCE OF GROUNDWATER

Cooler Climates ★ VERY IMPORTANT

- FROST WEDGING is more common in climates with MODERATE PRECIPITATION and temperatures that VARY ABOVE AND BELOW FREEZING
- *In New York, this results in pothole formation on area roads*

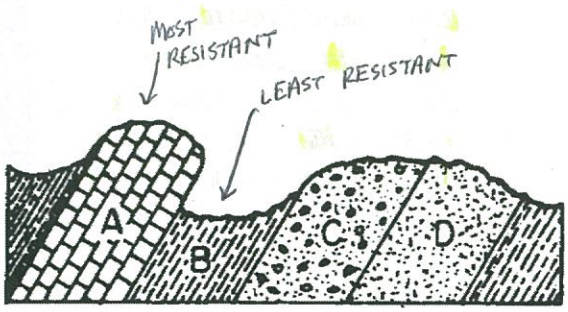




Particle Size ★

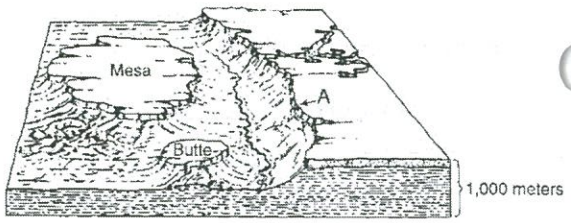
- *As rocks break apart, their* SURFACE AREA INCREASES AND THE RATE OF WEATHERING INCREASES

due to increased chemical and physical contact with the rock material



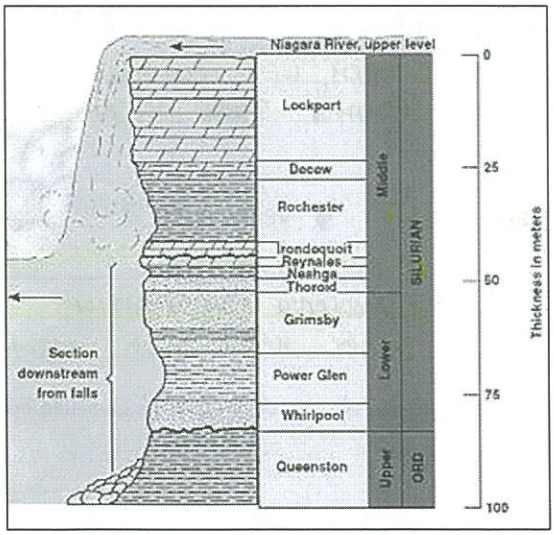
Bedrock Resistance

- *Certain bedrock types are more* RESISTANT *than others due to* MINERAL COMPOSITION AND HARDNESS
- MORE RESISTANT LAYERS STICK OUT FARTHER IN OUTCROPS (EXPOSURES) OF ROCK



WATERFALLS RESULT FROM VARYING BEDROCK RESISTANCE.

Niagara Falls has a hard cap rock of dolostone which resists weathering while less resistant rocks below are weathered away. Eventually the unsupported cap rock collapses and falls into the river below. Niagara Falls is steadily moving upstream due to this process.



Weathering and Soil

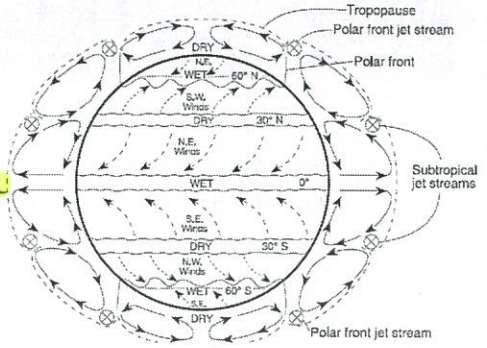
- *Over time,* WEATHERING OF SURFACE BEDROCK WILL PRODUCE SOIL
- *Soil depth is determined by the rate and period of weathering as well as biological (life) activity*

Layers of Soil

- *A-Horizon: topsoil, rich in organic matter*
- *B-Horizon: Subsoil, color changes, small particles of weathered rock*
- *C-Horizon: Partially weathered parent material*
- *Bedrock (un-weathered parent material)*

Soil Depth

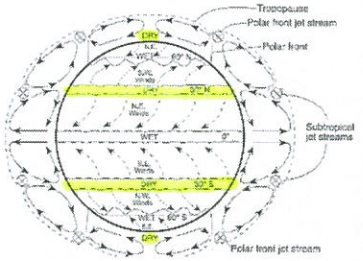
Soil depth is largely dependent on the amount of water (precipitation) present in that part of the world. This chart from the Earth Science Reference Tables allows us to infer where deeper soil will be.



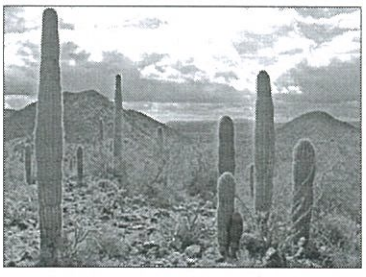
- INCREASED PRECIPITATION → INCREASED WEATHERING → DEEPER SOIL

Soils in Arid (dry) Regions

Consider soil from the Sonoran desert in the SW United States. Mostly sand, this soil was created when rock weathered primarily as a result of abrasion by wind-blown sand particles



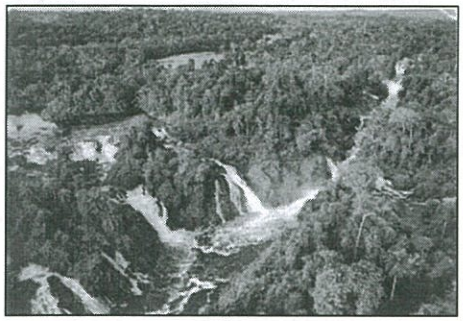
- SOIL DEPTH VARIES, BEDROCK EXPOSED, MOSTLY PHYSICAL WEATHERING FROM WIND-BLOWN SAND, ROCK AND SEDIMENTS ARE PITTED



Soils in Humid (wet) Regions

Consider soil from the rainforests along the equator. Soil is DEEP *as a result of consistent contact with water.*

- WARMTH, AND MOISTURE LEAD MOSTLY TO CHEMICAL WEATHERING
- AT HIGHER LATITUDES, COLD AND MOISTURE ALLOW FROST WEDGING TO PREVAIL



TROPICAL RAIN FOREST

NORTH AMERICAN RAIN FOREST